

DOCKET: SAMH 100002000

PATENT

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**  
**BOARD OF PATENT APPEALS AND INTERFERENCES**

INVENTOR:	Soon-Tae AHN	)	EXAMINER:	C.S. Kessler
		)		
SERIAL NO.:	10/583,399	)	ART UNIT:	1793
		)		
FILING DATE:	November 29, 2004	)	DATE:	June 16, 2011
		)		
FOR:	Steel Wire for Cold Forging Having Excellent Low Temperature Impact Properties and Methods of Producing Same			

Mail Stop Appeal Brief - Patents  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

**BRIEF FOR APPELLANT**

This is an appeal from the final rejection by the Examiner mailed March 11, 2011, rejecting claims 1-6. A notice of appeal and the appeal fee were timely filed on April 29, 2011.

Payment for \$270.00 for the appeal brief fee (small entity) is enclosed. Please charge any over or under payment to the assignee's Deposit Account No. 04-0566.

**REAL PARTY IN INTEREST**

The real party in interest is the assignee, Samhwa Steel Co., Ltd. of Pusan, Korea, owner of all rights in this application, whose address is 339-4, Samrak-Dong, Sasang-GU, Pusan, Korea.

### **RELATED APPEALS AND INTERFERENCES**

There are no appeals or interferences known to appellant or appellant's legal representatives, which will directly affect or be affected by, or have a bearing on the Board's decision on this appeal.

### **STATUS OF CLAIMS**

All claims of the application, nos. 1-6, stand rejected. The rejections of claims 1-6 are being appealed.

### **STATUS OF AMENDMENTS**

No amendment was filed after the final rejection of March 11, 2011. All the amendments made during prosecution of the application have been entered and are presently in the application.

### **SUMMARY OF CLAIMED SUBJECT MATTER**

Appellant's invention as recited in independent claim 1 is directed to a quenched and tempered steel wire which can be cold forged. Specification, p.5, ll.9-28.<sup>1</sup> The quenched and tempered steel wire comprises 0.10 – 0.40 wt% C (specification, p.7, ll.6-17), 1.0 wt% or less of Si (specification, p.7, ll.18-27), 0.30 – 2.0 wt% Mn (specification, p.7, l.28 - p.8, l.7), 0.03 wt% or less of P, 0.03 wt% or less of S (specification, p.9, ll.8-14), and a balance of Fe and impurities (specification, p.6, l.30). The quenched and tempered steel wire has an austenite grain size of 5 – 20  $\mu\text{m}$

---

<sup>1</sup> The reference to the specification herein is to the published PCT specification.

(specification, p.9, ll.25-27), impact absorption energy of 60 J/cm<sup>2</sup> or more at -40°C (specification, p.10, ll.23-27), and tensile strength of 70 – 130 kgf/mm<sup>2</sup> (specification, p.10, ll.18-19).

Appellant's invention as recited in independent claim 3 is directed to a method of producing a steel wire for cold forging. Specification, p.5, ll.9-28. The method comprises induction heating steel (specification, p.11, l.25 – p.12, l.7), which contains 0.10 – 0.40 wt% C (specification, p.7, ll.6-17), 1.0 wt% or less of Si (specification, p.7, ll.18-27), 0.30 – 2.0 wt% Mn (specification, p.7, l.28 - p.8, l.7), 0.03 wt% or less of P, 0.03 wt% or less of S (specification, p.9, ll.8-14), and a balance of Fe and impurities (specification, p.6, l.30), to an Ac3 transformation point or higher (specification, p.5, ll.18-23) so that austenite grain size is 5 – 20 µm (specification, p.9, ll.25-27). The method then comprises cooling the heated steel (specification, p.5, l.23), followed by heat treating the cooled steel (specification, p.5, ll.24-28) in such a way that tensile strength is 70 – 130 kgf/mm<sup>2</sup> (specification, p.5, ll.24-28 and p.10, ll.18-19) at a tempering parameter (P) ranging from 21,800 to 30,000 (specification, p.5, ll.25-28), which is expressed by Equation 1, so that impact absorption energy is 60 J/cm<sup>2</sup> or more at -40°C (specification, p.10, ll.23-27). Equation 1 is:

$$P = 1.8 \times (T + 273) \times (14.44 + \log t) \text{ (specification, p.6, ll.2-3),}$$

wherein, T is a tempering temperature (°C), and t is a tempering time (sec) (specification, p.6, ll.5-6).

## **GROUND OF REJECTION TO BE REVIEWED ON APPEAL**

The contested issues on this appeal are whether: 1) claims 5 and 6 comply with the written description requirement of 35 USC 112, first paragraph; and 2) claims 1-6 are obvious under 35 USC § 103 from Ahn et al. U.S. Patent Publication No. 2003/0066576.

## **ARGUMENT**

### **I. Rejection under 35 USC § 112, first paragraph**

Claims 5 and 6 stand rejected under 35 USC 112, first paragraph, for failing to comply with the written description requirement, namely, for the term induction heating "without plastic deformation."

Support for the term "without plastic deformation" in connection with induction heating is found in the specification at page 5, lines 18-28 and at page 11, line 25 to page 12, line 7, where no plastic deformation is described while heating to the Ac3 transformation point or higher.

By way of background, the specification describes the prior art as using in some instances non-heat treated steel that has been controlled during hot rolling. See, Specification, p.1, l.23 to p.2, l.6. Hot rolling is well understood to require plastic deformation while the steel is heated to a desired temperature, normally above the Ac3 transformation point.

The present invention takes a different course, and describes heat treating the steel wire rod to an Ac3 transformation point or higher to achieve the claimed austenite grain size of 5 – 20  $\mu\text{m}$ , impact absorption energy is 60 J/cm<sup>2</sup> or more at –40°C, and tensile strength is 70 – 130 kgf/mm<sup>2</sup>. As an Example of the instant invention, beginning

at p.11, l.24, a previously hot rolled wire rod was drawn to a diameter of 14.7 mm, and then subject to heating, quenching and tempering to achieve these properties. The specification does not state that the claimed heating method of the present invention, to an Ac3 transformation point or higher, is during hot rolling. The reference to "a hot rolled wire rod" in the Example is to the fact that the starting material had previously been hot rolled, and not that it was currently undergoing hot rolling while the described heating was taking place. Wire rod and other steel products that had originally been hot rolled are often subsequently described as such when they are used as the starting materials in other processes, such as the drawing that appellants describe in their Example. In the same way, appellant describes in the Example that he starts with wire rod that was originally hot rolled, but then describes the subsequent heating method of the present invention as being made with the use of a high frequency induction heater to raise the temperature to an Ac3 transformation point or higher. No plastic deformation is described in connection with such induction heating.

The case cited by the Examiner, *Ex parte Parks*, 30 USPQ2d 1234, 1236 (BPAI 1993), actually supports appellant's position. In the *Parks* case, the absence of any mention of the use of a catalyst was found to support the concept of practicing the method in the absence of a catalyst. The Board stated "[t]hroughout the discussion which would seem to cry out for a catalyst if one were used, no mention is made of a catalyst." *Id.* Likewise, in the present application, the description of the induction heating step would "cry out" for mention of plastic deformation if one were indeed employed. This is because plastic deformation was employed in use of the starting material, i.e., the hot rolled wire rod, and in subsequent cold forging of the wire rod

heat treated according to the invention. The fact that no plastic deformation was mentioned during the actual claimed induction heating step supports the concept that none was used.

Accordingly, the originally filed specification supports appellant's claim to heating steel to an Ac3 transformation point or higher "without plastic deformation."

## **II. Rejection under 35 USC § 103**

### **A. The cited prior art**

The Ahn publication, U.S. Patent Publication No. 2003/0066576, is also by the inventor of the present invention. Although the Ahn publication discloses a heating process and austenite grain size in a range partially overlapping that of the present invention, the Ahn publication relies only on the parameter  $n \times YS$  to determine suitability for cold forging, where  $n$  is the work hardening coefficient and  $YS$  is the yield tensile strength.

The Ahn publication does not disclose or suggest the tempering parameter  $P$  as disclosed and claimed by appellant, and neither of these prior art parameters  $n$  and  $YS$  involves the components of the instant claimed tempering parameter  $P$ , which are tempering temperature and tempering time in a logarithmic relationship. Moreover, the Ahn publication does not disclose or suggest the particular combination of austenitic grain size, impact absorption energy and tensile strength in the steel wire which results from the processing as disclosed and claimed by appellant.

### **B. Method claim 3 is not obvious from the Ahn publication**

In the claimed method of the present invention as described in claim 3, the inventor induction heats the steel to an Ac3 transformation point or higher so that an

austenite grain size is 5 – 20  $\mu\text{m}$ , and cools the heated steel. Subsequently, the cooled steel is heat treated at a tempering parameter (P) ranging from 21,800 to 30,000, where P is expressed by the equation:

$$P = 1.8 \times (T + 273) \times (14.44 + \log t)$$

wherein, T is a tempering temperature expressed in  $^{\circ}\text{C}$  and t is a tempering time expressed in sec. The resulting tensile strength is 70 – 130  $\text{kgf/mm}^2$  and impact absorption energy is 60  $\text{J/cm}^2$  or more at  $-40^{\circ}\text{C}$ ,

Neither appellant's method of heat treating according to the tempering parameter (P) nor the resulting quenched and tempered steel wire is obvious from the Ahn publication, which is also by the inventor. The Ahn publication seeks good cold forging properties for high strength quenched and tempered steel wires, but discloses a different process and parameter than the present invention, which process and parameter do not achieve the tensile strength and impact absorption energy as claimed by appellant in the instant application. Although the Ahn publication discloses a heating process and austenite grain size in a range partially overlapping that of the present invention, it does not disclose or suggest the tempering parameter P as disclosed and claimed by appellant. Moreover, the Ahn publication does not disclose or suggest the particular combination of austenitic grain size, impact absorption energy and tensile strength in the steel wire which results from the processing as disclosed and claimed by appellant. It is this novel and unobvious combination of parameters that achieves the unexpected advantage of high tensile strength and impact absorption energy to permit excellent cold forging of the steel wire.

The Examiner's entire case rests on the faulty supposition that "[the] Ahn [publication] teaches that each of the prior austenite grain size, yield strength, and tempering parameter are within ranges overlapping the instantly claimed range. March 11, 2011 Office Action, p.4. This is manifestly untrue, since the prior Ahn Publication mentions nothing about the claimed tempering parameter (P) – because the present inventor had not yet invented it! The Examiner then attempts to correct this misstatement by taking the position that "while [the] Ahn [publication] does not explicitly describe the formulation for P as claimed, the tempering temperature and time are such that the range of P in the invention method of Ahn would overlap that claimed (see [0041])." *Id.* However, any overlap in P (which the Examiner has not detailed) would not take into account the addition of the claimed austenite grain size of 5-20  $\mu\text{m}$ , which is only a small subset of the broad range of 5-90  $\mu\text{m}$  disclosed in the Ahn publication. Additionally, the Ahn publication does not recognize the combination of austenite grain size, tensile strength, tempering parameter P and impact absorption energy that are presently claimed.

Referring to Table 2, the inventor addressed the criticality of the claimed parameters by comparing samples of the present invention with Comparative Examples that had similar properties and processing methods, but did not have the claimed combination of those properties and processing methods. It can be noted that all of the Comparative Examples (CO. EX. 1-13) do not achieve the impact absorption energy 60 J/cm<sup>2</sup> or higher at - 40°C. This belies any assertion that the samples processed with the identical material and process to that of the Ahn publication will inherently have the impact absorption energy of the present invention.

The inventor of the present invention unexpectedly found that even though the identical material and similar process was used, the impact absorption energy at - 40°C could be substantially differentiated according to the combination of the tensile strength, the grain size, and the tempering parameter  $P$ . That is, it could be found that when any one among the three conditions does not belong to the range of the numerical values claimed in the present invention, it was impossible to obtain the impact absorption energy 60 J/cm<sup>2</sup> or higher at - 40°C.

This establishes the criticality that in order to obtain the high impact absorption energy at - 40°C, the organic relation between the tensile strength, the grain size, and the tempering parameter  $P$  is very important and must meet the values recited in appellant's claims. The cited Ahn publication makes no suggestion of the criticality of any of these parameters and, further, does not even recognize the tempering parameter  $P$  in any manner. By contrast, the Ahn publication relies only on the parameter  $n \times YS$  to determine suitability for cold forging, where  $n$  is the work hardening coefficient and  $YS$  is the yield tensile strength. Neither of these prior art parameters involves the components of the instant claimed tempering parameter  $P$ , which are tempering temperature and tempering time in a logarithmic relationship. Therefore, the present invention specifies and simplifies the tempering through the introduction of the tempering parameter  $P$  in such a way as for anyone to easily apply it to produce a quenched and tempered steel wire of the claimed excellent impact absorption energy and tensile strength which can be cold forged.

Accordingly, appellant's claimed process parameters and the properties of steel wire produced thereby are not obvious from, and patentably distinct over, the disclosure of the Ahn publication.

C. Claims 1 and 2 are not obvious from the Ahn publication

Appellant's quenched and tempered steel wire is defined in claims 1 and 2 with the same composition, austenite grain size, tensile strength and impact absorption energy as recited in method claims 3-6.

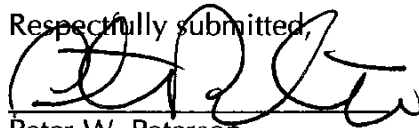
The Ahn publication does not disclose or suggest the particular combination of austenitic grain size, impact absorption energy and tensile strength in the steel wire as disclosed and claimed by appellant. It is this novel and unobvious combination of parameters that achieves the unexpected advantage of high tensile strength and impact absorption energy to permit excellent cold forging of the steel wire.

Accordingly, appellant's claimed properties of steel wire are not obvious from, and patentably distinct over, the disclosure of the Ahn publication.

**CONCLUSION**

For the reasons given above, appellant submits that the claims of the instant application fully meet the requirements of 35 USC §§ 112, first paragraph, and 103(a). Reversal of the rejection is respectfully requested.

Respectfully submitted,



Peter W. Peterson  
Reg. No. 31,867

**DeLIO & PETERSON, LLC**  
121 Whitney Avenue  
New Haven, CT 06510-1241  
(203) 787-0595  
samh100002000-AppealBrief.doc

**CLAIMS APPENDIX****Rejected Claims of Serial No. 10/583,399**

1. (previously presented) A quenched and tempered steel wire which can be cold forged, comprising 0.10 – 0.40 wt% C, 1.0 wt% or less of Si, 0.30 – 2.0 wt% Mn, 0.03 wt% or less of P, 0.03 wt% or less of S, and a balance of Fe and impurities, wherein an austenite grain size is 5 – 20  $\mu\text{m}$ , impact absorption energy is 60 J/cm<sup>2</sup> or more at –40°C, and tensile strength is 70 – 130 kgf/mm<sup>2</sup>.
2. (original) The steel wire as set forth in claim 1, further comprising at least one component selected from the group consisting of 0.05 – 2.0 wt% Cr, 0.05 – 1.5 wt% Mo, and 0.0003 – 0.0050 wt% B.
3. (previously presented) A method of producing a steel wire for cold forging comprising:
  - induction heating steel, which contains 0.10 – 0.40 wt% C, 1.0 wt% or less of Si, 0.30 – 2.0 wt% Mn, 0.03 wt% or less of P, 0.03 wt% or less of S, and a balance of Fe and impurities, to an Ac3 transformation point or higher so that an austenite grain size is 5 – 20  $\mu\text{m}$ ;
  - cooling the heated steel; and
  - heat treating the cooled steel in such a way that tensile strength is 70 – 130 kgf/mm<sup>2</sup> at a tempering parameter (P) ranging from 21,800 to 30,000,

which is expressed by a following Equation 1, so that impact absorption energy is 60 J/cm<sup>2</sup> or more at -40°C,

Equation 1

$$P = 1.8 \times (T + 273) \times (14.44 + \log t)$$

wherein, T is a tempering temperature (°C), and t is a tempering time (sec).

4. (original) The method as set forth in claim 3, wherein the steel further comprises at least one component selected from the group consisting of 0.05 – 2.0 wt% Cr, 0.05 – 1.5 wt% Mo, and 0.0003 – 0.0050 wt% B.
5. (previously presented) The method as set forth in claim 3, wherein the steel is induction heated without plastic deformation.
6. (previously presented) The method as set forth in claim 4, wherein the steel is induction heated without plastic deformation.

**EVIDENCE APPENDIX**

Declaration Under Rule 132 of Soon-Tae Ahn entered on March 15, 2010.

